

**Method and Device for Repairing Defective Pixels of A Liquid Crystal Display****Panel**

This application claims the benefits of Taiwan application Serial No. 911119315, filed Aug. 26, 2002.

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**BACKGROUND OF THE INVENTION****Field of the Invention**

[0001] The invention relates in general to a drive device and a drive method for the pixels of a liquid crystal display, and more particularly to a device and a method for repairing the defective pixels of a liquid crystal display.

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**Description of the Related Art**

[0002] While display technology is experiencing continual progress, the liquid crystal display (LCD) has become a mainstream product in the field of displays due to its advantages of low radiation and low power consumption as well as its physical features of being thin, small and short in size, and light in weight.

[0003] A liquid crystal display panel includes a plurality of pixels arranged

in the form of a matrix and displays the picture by inputting individual pixel data to control the brightness of a pixel.

[0004] A diversity of errors might occur during the manufacturing process of a display. For instances, the first metallic layer short-circuiting with the second metallic layer or the photoresist coating applied on the glass base panel peeling off will cause structural defects to a pixel. Under these circumstances, a pixel would be unable to display the corresponding brightness in response to the pixel data received. For example, the peeling off of photoresist coating will make a corresponding pixel much brighter than its adjacent pixels resulting in a bright spot defect. For the convenience of description, a pixel with structural defects is referred to as a 'defective pixel' hereinafter while a pixel, which always displays a higher level of brightness due to the peeling off of photoresist coating, a "bright spot". Bright spots not only deteriorate the display quality of a liquid crystal display panel but also reduce consumers' purchasing willingness.

[0005] Currently, the method for repairing the bright spot problem of a liquid crystal display panel is to repair the defective structure of a defective pixel and the peeling off of photoresist coating either manually or automatically. Since a pixel is small in size but complex in structure, it is difficult and time-consuming trying to examine and locate defective pixels to

further fix the defective structures. It is not economical in terms of the cost and labor required. Moreover, some of the structural defects cannot be repaired properly. Therefore, how to reduce the negative influence on the display quality of a liquid crystal display panel caused by defective pixels has  
5 become an important issue.

#### SUMMARY OF THE INVENTION

[0006] It is therefore an object of the invention to provide a device and a method for repairing defective pixels of a liquid crystal display panel to resolve the bright spot problem on a liquid crystal display panel caused by defective pixels in a more economical way which requires less time, money and labor.  
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[0007] It is another object of the invention to provide a device for repairing defective pixels of a liquid crystal display panel wherein the device for repairing defective pixels includes a defective pixel signal storage unit, a pixel signal storage unit, a location comparison unit and a pixel signal replacement unit. The defective pixel storage unit is used to output defective pixel signals, which represent the locations of defective pixels on a liquid crystal display. The pixel signal storage unit is used to output pixel signals while the pixel signal further comprises a first brightness and a pixel location signal, which represents the location of a pixel on a liquid crystal display.  
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- The location comparison unit, which is coupled to the defective pixel signal storage unit and the pixel signal storage unit respectively, is used to compare the defective pixel signal with the pixel location signal to determine whether the pixel signal is used to be inputted to the defective pixel signal or not.
- 5      The pixel signal replacement unit is coupled to the location comparison unit. When the pixel signal is used to be inputted to the defective pixel, the pixel brightness signal of the pixel signal will be replaced by a default brightness signal wherein the default brightness signal controls the pixel with a second brightness.
- 10     [0008]    It is another object of the invention to provide a method for repairing defective pixels of a liquid crystal display panel wherein the method for repairing defective pixels includes at least the following steps. First, obtain the locations of defective pixels on a liquid crystal display. Next, input a pixel signal wherein the pixel signal further includes a first pixel brightness signal used to control a pixel with a first brightness according to the pixel signal. When the pixel signal is used to be inputted to the defective pixel, the first pixel brightness signal of the pixel signal will be replaced by a default brightness signal wherein the default brightness signal controls the pixel with a second brightness. Of which, the second brightness, whose level of
- 15     brightness can be of complete darkness for instance, is dimmer than the first

brightness. Last, output pixel signals.

[0009] Other objects, features, and advantages of the invention will become apparent from the following detailed description of the preferred but non-limiting embodiments. The following description is made with reference

5 to the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 shows a block diagram of a device for repairing defective pixels of a liquid crystal display panel according to a preferred embodiment of the invention;

10 [0011] FIG. 2 shows a flowchart of a device for repairing defective pixels of a liquid crystal display panel according to a preferred embodiment of the invention; and

[0012] FIG. 3A ~ 3B are schematic diagrams illustrating the locations of pixels on a display panel represented by the enabling signal, the clock signal, 15 the horizontal synchronous signal and the vertical synchronous signal.

#### DETAILED DESCRIPTION OF THE INVENTION

[0013] The technology of the invention is featured by replacing the pixel

signals inputted to defective pixels with default pixel data of dark spots, so that the brightness of defective pixels as displayed on a liquid crystal display panel will constantly be of complete darkness. By doing so, not only can the bright spot problem caused by defective pixels be resolved, but also the display quality of a liquid crystal display panel be improved.

[0014] FIG. 1 shows a block diagram of a device for repairing defective pixels of a liquid crystal display panel according to a preferred embodiment of the invention. The defective pixel repairing device 100 includes a defective pixel signal set storage unit 102 and a pixel signal repair unit 104, wherein the pixel signal repair unit 104 further includes a pixel signal storage unit 106, a defective pixel signal storage unit 108, a location comparison unit 110 and a pixel signal replacement unit 112. Of which, the location comparison unit 110 is coupled to pixel signal storage unit 106 and defective pixel signal storage unit 108 whereas the pixel signal replacement unit 112 is coupled to the location comparison unit as shown in FIG. 1. It is noteworthy that the defective pixel repairing device 100 can be an independent circuit device or partly or totally installed in other circuit devices. For example, the user can install the entire defective pixel repairing device 100 in a scaler or other well-known circuit devices, or just install the entire or part of pixel signal repair unit 104 in a scaler or other well-known circuit devices.

[0015] FIG. 2 shows a flowchart of a device for repairing defective pixels of a liquid crystal display panel according to a preferred embodiment of the invention. First, perform step 202 to examine the liquid crystal display panel and obtain the location of every defective pixel on the liquid crystal display.

- 5 Next, perform step 204 to store the location of every defective pixel on the liquid crystal display panel in the defective pixel signal set storage unit 102 in the form of a defective pixel signal set. In the preferred embodiment of the invention, the location of every defective pixel on the liquid crystal display panel is represented by a defective pixel signal in the form of co-ordinates.
- 10 Assemble all the defective pixel signal to form a set of defective pixel signals and store the set in the defective pixel signal set storage unit 102 wherein the defective pixel signal set storage unit 102 can be a micro controller or an integrated circuit (IC).

- [0016] Following that, perform step 206 which inputs defective pixel signals and ordinary pixel signals to the defective pixel signal storage unit 108 and the pixel signal storage unit 106 respectively, wherein the ordinary pixel signal further comprises a pixel brightness signal used to make the pixel which receives the pixel signal display brightness according to the pixel brightness signal. A chromatic liquid crystal display panel has three kinds of pixels used to represent the red color (R), the green color (G) and the blue

color (B) respectively, and so do pixel brightness signals have the red color (R), the green color (G) and the blue color (B). Besides, an ordinary pixel signal further comprises a pixel location signal used to represent the location of the intended pixel of the pixel signal on a liquid crystal display. The  
5 location signal comprises a horizontal synchronous signal (Hs), a vertical synchronous signal (Vs), a clock signal (clk) and an enabling signal (En).

FIG. 3A ~ 3B are schematic diagrams illustrating the locations of pixels on a display panel represented by the enabling signal, the clock signal, the horizontal synchronous signal and the vertical synchronous signal. Referring  
10 to FIG. 3A, the horizontal location of a pixel on a liquid crystal display panel can be represented by the enabling signal, the clock signal, and the horizontal synchronous signal. Referring to FIG. 3B, the vertical location of a pixel on a liquid crystal display panel can be represented by the enabling signal, the clock signal, and the vertical synchronous signal. For example, the pixel  
15 located in the 2<sup>nd</sup> column and the 3<sup>rd</sup> row of a liquid crystal display panel can be represented using a clock signal labeled "2" in FIG. 3A and a horizontal synchronous signal labeled "3" in FIG. 3B.

[0017] After that, perform step 208 where the pixel signal storage unit 106 inputs ordinary pixel signals and the defective pixel signal storage unit 108  
20 inputs defective pixel signals to the location comparison unit 110 respectively.

The location comparison unit 110 obtains the location of a defective pixel according to the defective pixel signal and, according to the location pixel signal of an ordinary pixel signal, obtains the location of the pixel inputted by the ordinary pixel signal.

- 5 [0018] Next, perform step 210. After the location comparison unit 110 has compared ordinary pixel data and defective pixel data and has determined that the ordinary pixel signal is used to be inputted to a defective pixel, then perform step 212 to replace the pixel brightness signal of an ordinary pixel signal with the brightness signal of a dark spot. Of which, the 10 signal value of the brightness signal of a dark spot is used to make the pixel constantly display a level of complete darkness. The brightness signal of a dark spot is a low voltage signal if a VA mode liquid crystal display panel is used and is a high voltage signal if a TN mode liquid crystal display panel is used. In the invention, the pixel signal whose pixel brightness signal is 15 replaced by brightness signal of a dark spot is called a "dark spot pixel signal".

[0019] At last, perform step 214, which outputs the pixel signal. The method for repairing defective pixels according to the invention ends here.

[0020] The method for repairing defective pixels of a liquid crystal display

panel disclosed in the above preferred embodiments of the invention  
constantly set the brightness of defective pixels to be of complete darkness  
by controlling the pixel brightness signal of the inputted defective pixel. By  
doing so, not only can the bright spot problem caused by defective pixels be  
5 resolved economically in terms of time, money and labor, but also the display  
quality of a liquid crystal display panel be improved as well.

[0021] While the invention has been described by way of example and in  
terms of a preferred embodiment, it is to be understood that the invention is  
not limited thereto. On the contrary, it is intended to cover various  
10 modifications and similar arrangements and procedures, and the scope of the  
appended claims therefore should be accorded the broadest interpretation so  
as to encompass all such modifications and similar arrangements and  
procedures.